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EOSDIS Core System Project

Release B Verification Specification for the ECS Project

July 1996

Hughes Information Technology Systems
Upper Marlboro, Maryland

Release B Verification Specification for the ECS Project

July 1996

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SUBMITTED BY

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Preface

This document is a formal contract deliverable with an approval code 1. It requires Government review and approval prior to acceptance and use. This document is under ECS contractor configuration control. Once this document is approved, Contractor approved changes are handled in accordance with Class I and Class II change control requirements described in the EOS Configuration Management Plan, and changes to this document shall be made by document change notice (DCN) or by complete revision.

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Abstract

This Verification Specification (DID 403) contains summaries of release contents/capabilities, the full/partial Level 3 and Level 4 requirements necessary to fulfill Release B, the process of managing and tracking these requirements, and the mapping of these requirements to Release I&T, FOS I&T and Acceptance testing.

***Keywords**:* acceptance, build, capabilities, management, mapping, release, requirements, requirement category, scenario, system, test, thread, traceability, verification.

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1. Introduction

1.1 Identification

This document is submitted as required by CDRL item 065 DID 403, whose requirements are specified in this document as a required deliverable under the Earth Observing System Data and Information System (EOSDIS) Core System (ECS) contract (NAS5-60000).

1.2 Scope

This document stipulates the specific portions or functions of the system requirements to be verified by each of the tests and analyses in Release B volumes of the ECS Release Integration and Test Plan (DID 402) (SITP), the ECS Acceptance Test Plan (DID 409) (ATP) and FOS Release Integration and Test Plan (DID 402). It also specifies the verification methods as discussed in the ECS Verification Plan (DID 401).

1.3 Purpose

The purpose of the ECS Verification Specification document is to identify the verification methods and assigned tests, used by Release Integration and Test (I&T), Flight Operation Segment (FOS) and Acceptance, to verify each requirement. This document includes a description of the Requirements and Trace-ability Management (RTM) tool employed to trace requirements and matrix tables containing the requirements that must be met in Release B. These matrix tables include requirement identification, requirement text, assignment to requirement categories, identification of the verification methods discussed in greater detail in the ECS Verification Plan(DID 401), the Release Integration and Test Plans (SITP) test assignments and the Acceptance Test Plan (ATP) test assignments.

1.4 Status and Schedule

This version of the document due, specifically includes the requirements to be satisfied in Release B. As an approval code 1 document, the Verification Specification document requires Government approval prior to its acceptance and use.

1.5 Document Organization

The document is organized into eight sections, three appendices, plus an acronym list and glossary.

Section 1 - Introduction, describes and identifies the Verification Specification.

Section 2 -≠ Related Documentation, identifies the parent documents and information documents as they relate to the Verification Specification.

Section 3 -≠ Requirements Management, describes the Requirements and Trace-ability Management tool employed to track and manage the ECS requirements, discusses the relationship between requirements and Release I&T/Acceptance Test cases, and defines the Release I&T/Acceptance Test coding standards for test scenarios, test sequences, and test cases.

Section 4≠ Release B Requirements, a summary of the Release contents, and a Requirements Matrix containing: L4 Requirement Source IDs, extracted from the Level 4 Requirements class; Requirement Text, Verification Method, test, demonstration, inspection, or analysis; Release I&T/FOS Test.

It also contains Requirement Source IDs, extracted from the Requirements-by-Release class; Requirement Text, a detailed summary of the requirement; Requirement Category, mission critical, mission essential, or mission fulfillment; Verification Method, test, demonstration, inspection, or analysis; Release I&T/FOS Test Id, and Acceptance Test Assignments will be included in each section.

Appendix A - contains a table listing of all Release I&T Test Codes, corresponding Test Name, Test Case Name and Segment Id.

Appendix B - contains a table listing of all Acceptance Test Codes, paragraph IDs, and Test Case Name.

Appendix C - contains a table listing of all Release B FOS I&T Test Codes, corresponding Test Case Name and Segment Id.

Appendix D - contains a table listing of all Release B I&T Testcase cross reference with Release I&T Test Codes, L4 Requirement Paragraph Id and RBR Requirement Paragraph Id.

Appendix E - contains a table listing of all Release B Acceptance Testcase cross reference with Acceptance Test Codes and RBR Requirement Paragraph Id.

Appendix F - contains a table listing of all Release B I&T FOS Testcase cross reference with Release I&T Test Codes and L4 Requirement Paragraph Id.

Appendix AB-contains abbreviations and acronyms.

Appendix GL- contains glossary.

2. Related Documentation

2.1 Parent Documents

The parent document is the document from which this Verification Specification's scope and content are derived. The following document is the parent to the test processes and procedures addressed in this document.

423-41-02≠	Goddard Space Flight Center, Functional and Performance Requirements Specification for the Earth Observing System Data and Information System (EOSDIS) Core System (ECS)

2.2 Applicable Documents

The following documents are referenced within this Verification Specification, or are directly applicable, or contain policies and directive matters that are binding upon the content of this volume.

194-207-SE1-001	System Design Specification for the ECS Project
319-CD-001-003 402-CD-004-001	Flight Operations Segment (FOS) System and Segment Integration and Test Plan for the ECS Project
402-CD-003-001 319-CD-006-001	Release B System and Segment Integration and Test Plan for the ECS Project
409-CD-002-001	Release Overall System Acceptance Test Plan for the ECS Project
304-CD-004-003≠	Flight Operations Segment (FOS) Requirements Specifications for the ECS Project, Volume 2: AM-1 Mission Specific
304-CD-005-002≠	Release B SDPS/CSMS System Requirement Specifications for the ECS Project
222-TP-003-007≠	Release Plan Content Description for the ECS Project (Technical Paper)

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3. Requirements Management

3.1 Requirements and Trace-ability Management Tool

This section describes the process of tracking and managing requirements within ECS. The Requirements and Trace-ability Management (RTM) tool has been selected by the ECS project to aide in this tracking process. RTM provides the means to record all relationships and dependencies between requirements, documentation, releases, services, and, in this case, test specifications.

RTM assists systems engineers in defining requirements, assigning them to release, and mapping them to formal test cases. The current top-level structure of the RTM data base is shown in Figure 3-1. Requirements allocation flows from left to right, Level 2 (L2) to Level 4 (L4), within the diagram. Each class of requirements represents a further level of specificity and allocation to lower level design components or releases. The primary RTM classes are as follows:

- **Level 2 (L2)**. Contains requirements specified in Level 2 - Volume 1 and Volume 0.
- **Level 3_FPRS (L3_FPRS)**. Contains functional and performance requirements specifications received form GSFC 07/94 (423-41-02)
- **Requirements-by-Release**. Contains requirements expanded from L3_FPRS and IRD that are to be delivered in each release and with assigned requirement category: mission critical, mission essential, or mission fulfillment. These requirements are used by development engineers to develop the Level 4 requirements.
- **Level 4 (L4)**. Contains Level four requirements expanded from Requirement-by-Release class. In this level, requirements are allocated to subsystems and configuration items of each of the elements in ECS. The System Requirements Specification (DID 304) contains these requirements.
- **IRD**. Contains external interface requirements specified in Interface Requirements Documents (IRDs). These requirements are mapped to requirements in the L3-FPRS class and will be used to populate the Requirements-by-Release class.

Also contained within the RTM Class Definition Diagram (Figure 3-1) are three test classes:

- **Release Integration and Test (IT_B)**. Contains Release I&T test cases which will be mapped to requirements in the Requirements-by-Release and level 4 requirement class. These test cases are documented within the Release Integration and Test Plan (DID 402/319)
- **Acceptance Test (AT_B)**. Contains scenario-based test cases which will be mapped to requirements in the Requirements-by-Release class. These test cases are documented within the Acceptance Test Plan (DID 409).

- ≠ **Release Integration and Test (IT_FOS)**. Contains FOS Release I&T test cases which will be mapped to requirements in the Requirements-by-Release and level 4 requirement class. These test cases are documented within the FOS Release B Integration and Test Plan (DID 402/319).

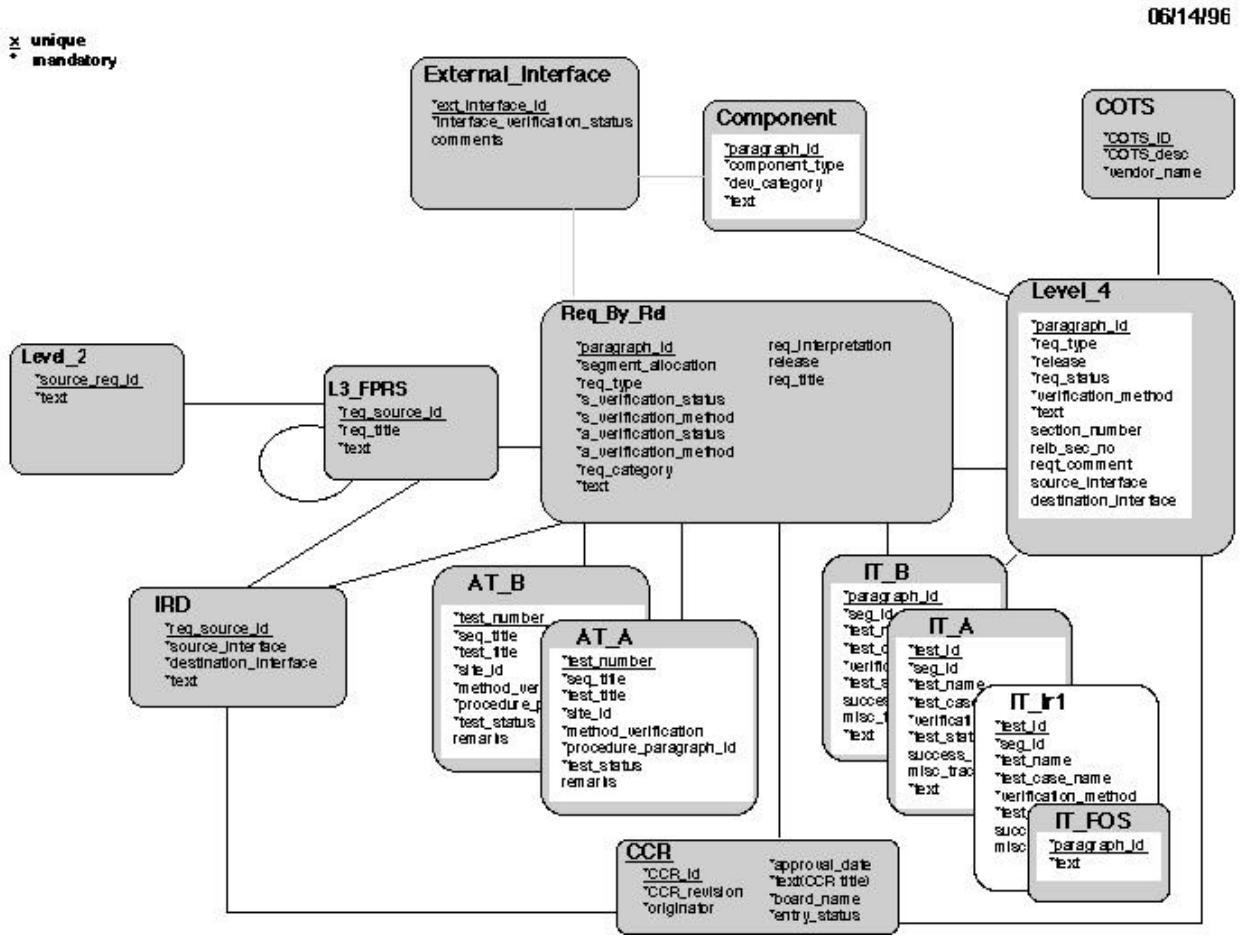

Figure 3-1. RTM Class Definitions Diagram

3.3 Requirements Verification Mapping

The expansion of requirements into the Requirements-by-Release class assists the Release Integration and Test team and Acceptance Test team in mapping test procedures/scenarios to individual functions or services. The expanded requirements contained in the Requirements-by-Release class hold a direct mapping to system builds and threads and acceptance test scenarios.

3.3.1 Release Integration and Test

Release I&T Test activities have been combined in Release B to handle both segment and system testing. In general, the Release I&T organization integrates and tests system functions in system threads and combines these threads into system builds. Each system build is tested, and merged with other system threads and/or other tested system builds into higher-level system builds. This process is repeated until the complete release is integrated and tested. Since each system build/thread is mapped to Requirements-by-Release requirements, and system test cases are mapped to system build/threads, the Release I&T organization is able to verify that all Level 3 and Level 4 requirements related to the release are satisfied.

Table 3-1. Definition of Verification Methods

Verification Method	Verification Definition
Inspection	The visual, manual examination of the verification item and comparison to the applicable requirement or other compliance documentation, such as engineering drawings.
Analysis	Technical or mathematical evaluation based on calculation, interpolation, or other analytical methods.
Demonstration	Observation of the functional operation of the verification item in a controlled environment to yield qualitative results without the use of elaborate instrumentation, procedure, or special test equipment.
Test	A procedure or action taken to determine under real or simulated conditions the capabilities, limitations, characteristics, effectiveness, reliability or suitability of a material, device, system or method.

Table 3-2. Definition of Requirement Categories

Requirement Category	Examples of Requirement Type
Mission Critical Requirements: Define functions necessary to protect ECS critical assets, e.g., the EOS platforms and instruments and the lowest level, irreplaceable data. Functions assure no loss of data and the capability to generate higher level data products.	• spacecraft instrument control, operations and backup, etc., to assure data gets to ground. • data capture, Level 0 processing, data delivery to DAACs, ingest of data to archive, Level 1a/1b processing, ability to find/access data for subsequent processing
Mission Essential Requirements: Provide basic services for long term data storage, data management necessary to serve the user community and the majority of earth science researcher service needs and data distribution needs.	• on-demand or routine production of standard data products • basic search, order, and subsetting services • basic accounting services • external agency linkage to standard support products
Mission Fulfillment Requirements: Advanced services targeted at increasing the earth science user's productivity. These include services to meet larger programmatic goals; provide intermediary support of educational, policy, and social services communities; and provide services for access to GCDIS and UserDIS.	• user implemented methods • user services to support analysis linkages • GCDIS expansions • external agency and international linkages to support user research and non-production dependent calibration • user-as-a-DAAC linkages so EOSDIS includes a user-DAAC • software support to GCDIS/UserDIS implementors

3.3.2 Acceptance Test Scenarios

Test scenarios provide the basic framework for ECS system-level acceptance testing. These scenarios describe a representative, chain of events that entail science user and operations interactions with the ECS. They are modeled as stimulus/response patterns which form a logical sequence of operations. By using scenarios in acceptance testing, events that would occur during ECS operations are executed prior to Government acceptance. Since each scenario is driven by, and mapped to, its underlying level-3 requirements, these requirements are verified by virtue of executing the scenario. When taken together, these scenarios can be traced to all ECS level-3 requirements. Thus, level-3 requirements are satisfied during acceptance testing to the extent that the scenarios themselves are verified.

3.3.3 FOS Release B Integration and Test

FOS Integration and Test activities have been combined in release B to handle both segment and system testing. In general, the FOS I&T organization integrates and tests system functions in system threads and combines these threads into system builds. Each system build is tested, and merged with other system threads and/or other tested system builds into higher-level system builds. This process is repeated until the complete release is integrated and tested. Since each system build/thread is mapped to Requirements-by-Release requirements, and system test cases are mapped to system build/threads, the FOS I&T organization is able to verify that all Level 3 and Level 4 requirements related to the release are satisfied.

3.4 Release Requirements Matrix Format

The remaining sections of this document include requirements matrices, extracted from the RTM tool, specific to each release. These matrices depict the trace-ability between Level 4 and Level 3 requirements and Release I&T, FOS I&T and Acceptance Test assignments. Specifically, the matrices contain the following items, which are shown as column headings:

- •≠ **Requirement-by-Release Source Id or L4 Requirement Source Id**. The Level 3 and Level 4 requirement identifier, obtained from the Functional and Performance Requirements Specification for the ECS (423-41-02), and. Example: "EOSD0010"
- •≠ **Requirement Text**. The text of the Requirement-by-Release requirement and level 4 requirement. Example: "ECS shall use and support the Space Network (SN), via the EDOS/Ecom interface, to obtain the forward and return link data communications needed to achieve full end-to-end ECS functionality"
- • ≠ **Requirement Category**. The priority of each requirement. The options include: mission (critical), mission (essential), and mission (fulfillment).
- •≠ **Verification Method**. The method of verifying each requirement. The options include: test, demonstration, analysis and inspection.

- **Release I&T Assignment**. The Release Test Assignment column contains release test codes, extracted from the Release I&T Class in RTM, to identify the test cases used to verify each requirement. These test codes were derived from the Release Integration and Test Plan's (DID 402). The format of the code is divided into two categories: thread and build.
  - Build test codes contain:

    B - Build

    R - Release B is 2

    bb - Build Number

    pp - Phase Number

    TT - Test Number

    Combined together, the Release I&T build test codes are derived - BRbb.pp.TT. Example "B211.02.01". This belongs to a Release B Build. It is testcase 1 of build 11, scheduled to be executed in phase 2.

  - Thread test codes contain:

    T - Thread

    R - Release B is 2

    bb - Build number

    dd - Drop number

    pp - Phase number

    TT - Testcase number

    Combined together, the Release I&T thread test codes are derived - TRbb-td.pp.TT. Example " T211-11.02.01" belongs to a Release B thread. It is testcase 1 in thread 1 of build 11, scheduled to be executed in drop 1 of phase 2.).

- **Acceptance Test Assignment**. The Acceptance Test Assignment column will contain Acceptance Test codes, extracted from the Acceptance Test Class in RTM, to identify the scenarios and test cases used to verify each requirement. The format of this code includes:

  R - ATP Release identification

  GG - Group number as identified in ATP

  ss - Scenario number as identified in ATP

  SS - Sequence number as identified in ATP

  xxx - Test case number as identified in ATP

Combined together, the Acceptance test codes are derived - RGGssSS.xxx. Example "B080210.110". (For a description of the scenarios and testcases, see DID 409).

- FOS **Release I&T Assignment**. The Release Test Assignment column contains release test codes, extracted from the FOS Release I&T Class in RTM, to identify the test cases used to verify each requirement. These test codes were derived from the FOS Release Integration and Test Plan's (DID 402).
  - Test codes contain:

    SSS - Subsystem

    B - Build Release

    TT - Test Number

    R - Release B

    Combined together, the FOS Release I&T build test codes are derived - SSS-BTTR. Example "ANA-1000B".